

## Center for Orthopaedic Research

The **Center for Orthopaedic Research** advances novel concepts through translational studies that bridge basic science research and clinical practice to develop breakthrough therapies in patient diagnosis, treatment and outcome.

The **Center for Orthopaedic Research** also serves as a research training center for orthopaedic residents, medical students, graduate students, undergraduate students and visiting research scientists and clinicians.

Funding awards from prestigious government agencies and private foundations include the **National Institutes of Health**, **Department of Defense**, the **Orthopaedic Research Society**, the **Orthopaedic Research and Education Foundation** and the **Orthopaedic Scientific Research Foundation**. These awards and the continuous support of our patients and friends have enabled us to move forward with our research endeavors.

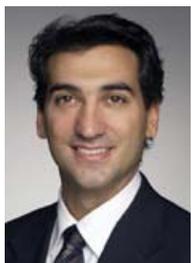
### Department Orthopaedic Surgery COR Executive Staff



**Dr. Louis U. Bigliani** is the Frank E. Stinchfield Professor & Chairman of Orthopaedic Surgery. He serves as Chief of the Center for Shoulder, Elbow & Sports Medicine and as the Chair for Orthopaedic Research.



Director, **Francis Y. Lee, MD, PhD** is an Associate Professor of Orthopaedic Surgery & Vice Chair for Research. He is the first orthopaedist from Columbia University to be awarded tenure. Dr. Lee is one of a handful of orthopaedists to receive NIH R01 and Dept. of Defense funding. He promotes departmental academic and research activities.



**Dr. Christopher S. Ahmad** is the Director of the COR Biomechanics component. Dr. Ahmad is an Associate Professor of Clinical Orthopaedic Surgery & serves as the Chief of Adolescent & Pediatric Sports Medicine. He is the head team physician for the New York Yankees.

### Orthopaedic Research Society

The COR team has received national recognition at the Orthopaedic Research Society's annual meetings. Our success rate for abstract acceptance and podium presentations has been significant with a combined representation of twenty-four abstracts/podium presentations for the 2010 and upcoming 2011 meetings.

#### *Center for Orthopaedic Research*

650 West 168th St.  
New York, NY 10032  
Phone: 212-305-7965

#### *Columbia Orthopaedics*

630 West 168th St.  
New York, NY 10032  
Phone: 212-305-5974

<http://www.columbiaortho.org/cor/index.html>

## Columbia Orthopaedics



## Center for Orthopaedic Research



COLUMBIA UNIVERSITY  
MEDICAL CENTER

NewYork-Presbyterian

## Center for Orthopaedic Research

The Department of Orthopaedic Surgery has a rich innovative history in basic science and clinical research. Under the guidance of director, **Francis Y. Lee, MD**, the COR team cultivates research through experimentation, data collection, *in vitro* and *in vivo* studies and outcome discussions. Our department is surrounded by Columbia University Nobel laureates and world-renowned clinical and basic science scholars in the complementary fields of immunology, rheumatology, biomedical engineering, imaging and orthopaedic surgery. COR research takes a multi-disciplinary approach across disciplines and campuses.

We strive to develop and educate future **clinician-scientists** with skill sets that will enable them to develop fundable research with the potential to enhance clinical outcomes and promote human health.

### Resident Research Scholar

- **Goal**—To offer a well structured research opportunity for a selected orthopaedic resident at New York Presbyterian/ Columbia University Medical Center.
- **Time Line**—Six year track for a selected candidate interested in both research & an academic career track.
- **Commitment**—One year of translational research & scholarly endeavors; grant writing & publication development.
- **Outcome**—A foundation for an academic career path & exposure to research & award winning scholars from complementary disciplines throughout the university/hospital setting.

### Faculty Advisory Board

**Louis U. Bigliani, MD** Professor & Chair

**William N. Levine, MD**, Professor & Vice Chair  
Residency Program Director

**Francis Y. Lee, MD, PhD**, Vice Chair for Research

[www.columbiaortho.org/residentsandfellows/eras\\_application.html](http://www.columbiaortho.org/residentsandfellows/eras_application.html)

## COR 2011 Research Projects

### Molecular Biomedical Engineering Projects

PI - Francis Lee, MD, PhD

#### Inflammatory Bone Loss in Implant Loosening

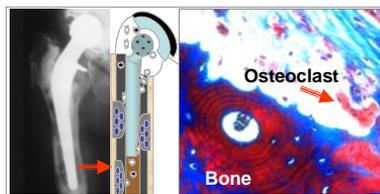
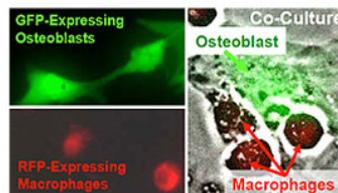


Figure 1. Periprosthetic Inflammation & Osteolysis

Polyethylene wear particles are known to stimulate macrophages and osteoblasts to produce tumor necrosis factor alpha (TNF- $\alpha$ ) and other pro-osteoclastogenic cytokines. For this **NIH R01** project, PI: Francis Y. Lee, MD set out to delineate the mechano-biological interaction between biomaterials and the host immune system to enable the development of techniques that can prevent or treat biomaterial induced inflammatory bone loss by targeting pro-inflammatory pathways.



#### ERK Signaling

The long-range goal of this **NIH R01** funded project, PI: Francis Y. Lee, MD is to develop a preventive and preemptive strategy against inflammatory bone loss by targeting osteoblast-mediated immune pathways with specific topical or systemic inhibitors of ERK and associated molecules.

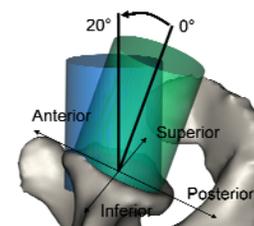
#### Ready-to-Use Tissue Construct for Military Bone & Cartilage Injury



Advancements in tissue engineering offer hope for improving treatment of large segmental bone fractures. Our ready-to-use tissue constructs have successfully used growth factors for accelerated healing and provided early mechanical stabilization in the small animal model. This **Department of Defense** funded project, PIs: Francis Y. Lee, MD and Jeremy Mao, PhD, DDS has been green-lighted to proceed with a large animal model.

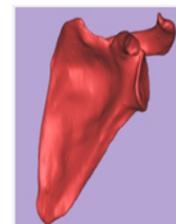
### Biomechanics Laboratory Projects

PIs - Louis U. Bigliani, MD, William Levine, MD & Christopher S. Ahmad, MD  
Computer Surgical Simulation

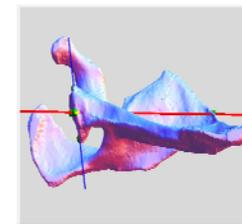


Shoulder reaming scenarios.

The COR Biomechanics Laboratory collaborates with our Center for Shoulder, Elbow & Sports Medicine, Pediatric Orthopaedic Research Group, Trauma Training Center, Hand Service, Center for Hip & Knee Replacement and Spine Service. Studies apply fundamental engineering principles to soft tissue testing to answer questions on the efficacy and improvement of different surgical techniques. 3D patient specific models are created from CT scans which are utilized in finite element analyses and computer surgical simulation programs to optimize surgical implant choice, placement and fit, while minimizing bone loss.



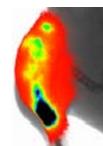
3D Shoulder Model



Anatomic Coordinate System

### COR Cancer Research

COR cancer research, PI: Francis Y. Lee is focused on chemo-resistant osteosarcomas. By blocking ERK1/2 signaling pathways both *in vitro* and *in vivo*, sarcoma cell death increased by up-regulating pro-apoptotic genes and by inhibiting potential drug resistant mechanisms. This research is pending publication in the *J. of Bone & Joint Surgery*.



Osteosarcoma Bioluminescence Imaging